06/30/14

The Department of Toxic Substance Control's (DTSC) selection of spray foam with unreacted isocyanate, as a priority product under the Safer Consumer Products program is flawed and unsubstantiated. The initial Spray Foam Product Priority Profile (PPP) is inaccurate and has been demonstrably economically damaging to the polyurethane spray foam industry.

DTSC made their selection of spray foam with unreacted isocyanate without transparency, and without any dialogue with the industry, who are experts on the science of spray foam. Due to the lack of transparency, the secretive nature of the internal selection process, and DTSC's own admission that there were "no metrics or priorities" used in the initial selection process, the spray foam industry is insisting that DTSC remove spray foam with unreacted isocyanate from the Safer Consumer Products process and start over, with a transparent and public process with metrics. In doing so, the DTSC will be able to develop a program the public has an understanding of, and confidence in, while allowing time to correct the misinformation they have published related to spray foam with unreacted isocyanate. Without starting over, the public has little confidence in the process and any industry could be targeted and ambushed in a manner similar to what has happened to the spray foam industry. The spray foam industry is widely recognized as an industry that is critical to California in lowing greenhouse gasses due to its energy saving benefits.

DTSC failed in their initial Spray Foam PPP to justify its selection to meet the California Safer Products regulatory and legal standards. DTSC has confused and mislead California consumers by changing their product-chemicals of concern, continuously revising its spray foam definition, not correcting published misstatements; all the while hiding behind website disclaimers and blanket public forum remarks as “best available knowledge at the time.”

DTSC has failed to follow up on their public commitments to correct misinformation on their website. At all three public workshops, Sacramento, Oakland, and Los Angeles, interested parties from the spray foam industry asked DTSC to either correct or remove documents that suggest a ban of spray foam is appropriate, that substitute products should be used when possible, or that DTSC literature suggests spray foam is unsafe. DTSC publicly agreed to make changes. As of the writing of these comments DTSC has posted a difficult to find disclaimer with nuanced language. The industry insisted that the disclaimer was inadequate in the final workshop, yet DTSC has failed to make corrections to their material misstatements on the science or their documents that, intentional or not, suggest use of substitute products is appropriate.

DTSC created undue harm to the polyurethane spray foam industry in this “pre-regulatory phase” by stating the wrong product-chemical (TDI/HDI) associated with spray foam, not defining the spray process, not initially clarifying whether cured foam products are under scrutiny, and broadly selecting multiple professional spray foam applications regulated by OSHA and combining these commercial scale products with consumer products with differing chemistry that are generally available over the counter.

DTSC took years to select its (3) initial priority product profiles, but couldn’t get spray foam polyurethane chemistry right. DTSC chose to publish their PPP, while not fully understanding the chemistry of spray foam with unreacted isocyanate and has conducted a very public green chemistry experiment on spray foam, and using the Safer Consumer Product process to learning the basics of polyurethane chemistry. It is this lack of sophistication or forethought that has caused the industry undue harm. To illustrate DTSC's misunderstanding of the chemistry, it should be noted that DTSC published the PPP as "spray foam containing unreacted isocyanate". Spray foam is not a singular compound, but a subcategory of reaction polymers containing polyurethane, polyurea, or polyisocyanurate bonds.

Spray Foam is made from a diverse selection of raw material ingredients, and their weight percentages will vary by end use application. Further, spray foam can be mixed using broad processing parameters depending on real world field conditions. Spray foam is most commonly understood as a cellular polyurethane polymer created using PMDI isocyanate and a blended mixture of hydroxyl containing long chain or aromatic resin compounds with NCO index of 100-110. Spray Foam is made from reaction of polymeric MDI isocyanate blend (2,4 MDI monomer; 4,4 MDI monomer; 2,2 MDI monomer, MDI oligomers; and MDI trimers) combined with different resins containing unique reactive groups (alcohols, polyesters, polyethers, amines), at different indexes and mix ratios.

The hazard risk of the chemical of concern (MDI) is not located inside the curing foam on a substrate. During the transient reaction state of liquid (during rising) to formation of soft plastic (the dry to touch skin), the MDI is non detectable at the surface and inside it's not proven to be in aerosol state nor is it likely even in an unreacted MDI monomer, but a new short chained urethane polymer connected by at least one thermoset bond, reducing its isocyanate functionality and lowering it's overall hazard trait.

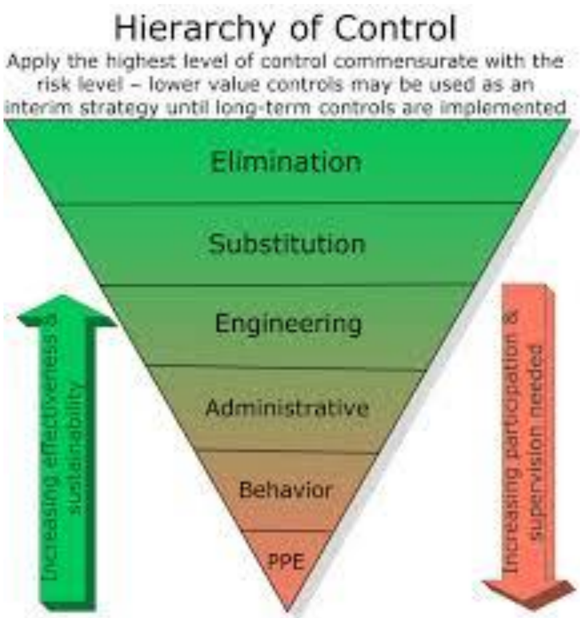
In the past, the spray foam industry defined full cure times as when the foam reached maximum physical properties. However, to properly address DTSC's exposure concern, one should define safe use as when no respirable MDI monomer is present to cause occupational asthma. The safe use of spray foam occurs well before exothermic heat has dissipated and full polymerization has hardened the cellular plastic. From the MDI monomer perspective, there are really two separate conditions: 1. The reacting liquid foam which is non detect for MDI monomer as soon as it changes in color (cream state) and is undergoing initial polymerization. 2. Any remaining residual MDI monomer in aerosol form remaining from the spray process that has not decomposed.

Fortunately, spray foam's risk factors are balanced by the naturally beneficial properties of the MDI monomer in a high-energy airborne state. The fine particle size produced has a strong chemical affinity to a similarly conditioned reactive resin group leading to quick initial polymerization bond formation and falling out of the airborne state as reacting foam droplets.
The reaction of spray foam is rapid with the liquid aerosol polymerizing, and rising in the cream state to hardening in the tack free state, which may be less than 10 seconds; thus likely a non-detect of MDI at the foam surface immediately upon installation.

Additionally, in roofing the extremely low, meaning parts per billion, level of concentration of MDI monomer not associated closely with a resin group, are likely outside the spray pattern, and are highly dispersible due to the molecules mechanical velocity from the spray gun and evaporation of blowing agents like carbon dioxide. Thus, formulation composition can change the spray foam hazard trait as it affects the MDI monomer availability sufficient to cause harm along with its time and distance dispersion factors. The higher external dispersion factors such as cross wind and higher ambient temperature during application greatly lowers MDI monomer concentration outside the spray pattern thereby contributing to higher probability of non detect MDI monomer levels. Additionally, in exterior roof waterproofing, the high affinity of MDI monomer at an elevated temperature and in aerosol form facilitates rapid reaction with atmospheric moisture to hydrolyze (decompose) the isocyanate to amine then to inert urea; effectively neutralizing the functional group of concern before potential contact with anyone nearby. DTSC has not responded to our inquiries about the chemistry outlined above, and it would be helpful if DTSC could explain their understanding of this chemistry and how it played a role in their listing of spray foam with unreacted isocyanate, or how they will use the information moving forward.

Finally, the formulation of interior air sealing open cell insulation is produced with excess (high) water content at 20-30 percent by weight in resin blends contributing to the beneficial reaction to cellularize the plastic using by-product carbon dioxide from the isocyanate - water reaction. This higher water content in open cell interior insulation results in a unique spray foam index with more unbound water molecules available to react with free MDI monomer to form inert urea.

Spray foam is specifically formulated for many end use applications, and broad performance requirements. The resin blend (commonly referred to as the B side) in Spray Foam contains reactive monomer compounds, catalysts, surfactants, blowing agents, fire retardants, water, cross linkers, and colorants, all of which affect the foam's rising, curing, spray-ability, adhesion, insulation values, strength properties, durability, fire classification, and its potential hazard traits. We are concerned DTSC does not understand, or has not contemplated the complexity of this science in their reasons for listing "spray foam."



Following the principles of green chemistry as outline by the state of California in 2010, OEHHA defines “Hazard traits” are properties of chemicals that fall into broad categories:

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- Toxicity
- Adverse environmental effects,
- Physical hazards,
- Exposure potential characteristics

Further OEHHA defines “chemical substance” as the following:

- Chemical,
- Chemical compound,
- A Chemical mixture,
- Elemental material,
- Particulate matter or fiber,
- Radioactive agent,
- Metabolites,
- Degradation by-products.

“Adverse effect” for toxicological hazard traits and endpoints means a biochemical change, functional impairment, or pathologic lesion that negatively affects the performance of the whole organism, or reduces an organism's ability to respond to an additional environmental challenge.

§ 69403.16 Respiratory Toxicity

(a) The respiratory toxicity hazard trait is defined as the occurrence of adverse effects on the structure or function of the respiratory tract following exposure to a chemical substance, including respiratory tract injury or decreased ability of the lungs to function in gas exchange.

(b) Toxicological endpoints for respiratory toxicity include, but are not limited to those indicating: respiratory irritation; pathological changes to the airway or other lung structures; inflammation; fibrosis; hypersensitivity pneumonitis; airways hyper responsiveness; altered lung function; asthma; airways remodeling; increased respiratory infections; altered composition of bronchoalveolar lavage fluid.

(c) Other relevant data include but are not limited to: *in vitro* evidence for respiratory toxicity; particle size distribution inclusive of respirable particles; respirable fibers; long half-life in the lung; chemical reactivity; redox potential; structural or mechanistic similarity to other chemical substances that are toxic to the respiratory system.

The Spray Foam product-chemical exists only in transient reaction state, for which time, temperature, humidity and other formulation blend reactants control the hazard trait amount, reactive state, and probability for adverse impact. The MDI isomer is highly reactive to form beneficial polymer or inert decomposed by-product, thus regulating product-chemical monomer at detectable parts per billion amounts for all polyurethane types and cannot be uniformly simplified due to its formulation changing concentration levels, reactant state, dispersion patterns, degradation reaction time and sensitivity to the presence of atmospheric moisture.

The choices in spray foam formulation affect chemistry (mixing, rising, and curing profiles) and physics (probability of polymerization versus time and free monomer distribution) factors, which impact unreacted MDI hazard traits:

- Unreacted MDI isocyanate toxicity –
  - Free monomer level (concentration),
  - Free monomer reactive condition (energy state)
  - Free monomer size and availability (4.4 versus oligomers)
- PMDI types - potential for inhalation and adverse medical impact
  - MDI monomer, oligomer and trimer content (vapor pressure and reactiveness)
  - Pre-polymer content – pre-reacted lower risk, larger molecule
- Resin compound factors – reaction completeness, process time
  - Reactive groups – type and number of active sites
  - Steric hindrance – branched, cyclical, primary and secondary
- Blowing agent type and amount
  - Free monomer probability to stay in spray pattern and resultant polymerization
- Catalyst types and amount –
  - Free MDI monomer probability after mixing and before curing
  - Process time for beneficial or adverse human or environmental effects,
- Overall formulation can effect degradation products and bi-products,
- Spray parameters (temperature / pressure) and equipment choice
  - Spray pattern size and density
  - Free MDI monomer dispersion rates away from the spray cone
  - Free MDI proximity (distance) to workers – Gun tip to surface

DTSC did not select a single, direct consumer product, but a broad bundle of polyurethane technologies, that are in fact (5) five, product-chemical uses containing wet or "uncured" diisocyanates (MDI monomer and mixed isomers):

1) Bead caulk:
    - Consumer Product, single use, one component can
    - Non-aerosolizing, continuous bead dispensed through clear tubing direct to substrate.
    - Inert internal propellant required to dispense
    - Big box channel distribution
    - Formulated with prepolymers technology
    - Used by consumers as well as contractors for crack sealing or void filling
    - PPE – gloves and eye protection suggested, but no personnel training required
    - No California use data showing consumer asthma or adverse harm
    - Users, not regulated by OSHA

2) Repair sealant:
    - Contractor Grade, single or multiple use
    - 2-component low pressure portable kit
    - Froth process @100 psi – 200 psi dispensing with pre-reacted stream through static mixer gun.
    - Inert internal propellant required to dispense
    - Formulated for various repair applications
    - Contractor supply distribution
    - PPE – gloves and eye protection suggested, no additional personnel training required
    - No California use data showing occupational asthma or adverse harm from this type of product
    - Users, contractor regulated by OSHA, but not product

3) Air sealing interior insulation:
    - Professional Grade, sold in drum kits – Interior use
    - Open celled, ½ pcf. density, water blown chemistry
    - 2-component high pressure (1200 psi / 150F) system
    - Requires sophisticated 20 lbs. per min. plural component equipment usually in fully equipped trailer.
    - Installed inside residences and commercial – attic, ceilings, crawlspaces, and stud wall
    - Formulated to meet interior building code fire classification
    - Direct Manufacturer and specialty insulation supply distribution
    - PPE – respirator (fresh air suggested), gloves, protective clothing, and eye protection required
    - Extensive personnel, product and equipment training
    - Professional Contractor with CA Insulation license

  - No California use data showing occupational asthma or adverse harm from this type of product
  - Users, Highly Regulated by OSHA and EPA.

4) Vapor retarder interior insulation:
   - Professional Grade, sold in drum kits – Interior use
   - Closed celled, 2 pcf. density, HFC-245fa chemistry
   - 2-component high pressure (1200 psi / 130F) system
   - Requires sophisticated 30 lbs. per min. plural component equipment usually in a fully equipped trailer
   - Installed inside residences, agricultural and commercial – attic, ceiling, stud wall, crawl spaces, produce storage facilities.
   - Formulated to meets interior building code fire classification
   - Direct Manufacturer and specialty insulation supply distribution
   - PPE – air purifying respirator (fresh air suggested), gloves, protective clothing, and eye protection required
   - Extensive personnel, product and equipment training
   - Professional Contractor with CA Insulation license
   - No California use data showing occupational asthma or adverse harm from this type of product
   - Users, Highly Regulated by OSHA and EPA

5) Exterior roof waterproofing:
   - Professional Grade, sold in drum kits – Exterior Use
   - Closed celled, 3 pcf. density, HFC-245fa chemistry
   - 2-component high pressure (850 psi / 120F) system
   - Requires sophisticated 40 lbs. per min. plural component equipment usually in commercial box truck
   - Installed on top of building code approved roof substrate for Industrial, agricultural and commercial buildings.
   - Formulated to meet exterior building code fire classification
   - Direct Manufacturer and specialty roofing supply distribution
   - PPE – air purifying respirator, gloves, protective clothing, and eye protection required
   - Extensive personnel, product and equipment training
   - Professional Contractor with CA Roofing license
   - No California use data showing occupational asthma or adverse harm from this type of product
   - Users, Highly Regulated by OSHA and EPA

Additionally, DTSC has failed to completely define the primary qualifying parameter “spraying” by only stating generically an aerosol or vapor in physics state without clarifying as any temporary detectable level MDI isomer or only in identified listed MDI monomers amount above PEL exposure level for the chemical of concern.

DTSC has failed to clarify “spraying” from a mechanical mixing methodology with a consistent engineering description, which explains both a rising, cellular bead dispensed via a plastic tube with no free MDI detectable, and high pressure impingement gun emitting an intermediate reaction foam droplet with “potential detectable unreacted free MDI monomer.” As DTSC has failed to provide sufficient clarity on chemical and mechanical spray process and limits, any revised spray foam PPP must provide a clear definition of spraying foam. Finally, the spray foam PPP must defined as to show that spraying foam produces enough unreacted MDI monomer available to potentially expose consumers to widespread and adverse harm by respiratory asthma.

Due to the lack of a transparent process, a demonstrated lack of justification based upon the documents published by DTSC, and failure to properly define product categories of spray foam, it is imperative that DTSC stop this process, mitigate the damage to the spray foam industry, and develop a process that consumers can have confidence in, prior to listing priority products. Short of that, DTSC must demonstrate a stronger understanding of the chemistry involved, and be more definitive in what they are attempting to accomplish with clarity to what chemicals and products are under review.

I make myself available at your convenience to answer any questions related to my submittal and look forward to your response.

Regards,

Will Lorenz
National Sales Manager
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Appendix 1 – Regulatory and Exposure Limits for MDI

EPA. The EPA's Integrated Risk Information System (IRIS) program has developed a reference concentration (RfC) for MDI of 6 x 10^{-4} mg/m^3 using histopathological changes in the upper respiratory system in animals as the critical effect (EPA, 1998).

OSHA. Diisocyanate hazards are addressed by OSHA in specific standards for the general industry, shipyard employment, and the construction industry, including PELs for workplace exposure. OSHA's PEL for the MDI monomer is 0.2 mg/m^3 (0.02 ppm) as a ceiling limit (29 CFR § 1910.1000). OSHA also requires the use of PPE to reduce worker exposure to hazards when engineering and administrative controls are not feasible or effective in reducing exposure below its PELs.

NIOSH. In 1996 and 2006, NIOSH issued Alerts to prevent asthma and death from diisocyanate exposure to workers in certain situations (NIOSH, 1996; NIOSH, 2006). NIOSH considers SPF insulation application to present hazards similar to other spray polyurethane applications and recommends use of the same safety procedures and PPE.

NIOSH's Recommended Exposure Limit (REL) for the MDI monomer is a Time Weighted Average (TWA) of 0.05 mg/m^3 (0.005 ppm) for up to a 10-hour workday during a 40-hour workweek with a ceiling limit of 0.2 mg/m^3 (0.02 ppm) for any 10-minute period (NIOSH, 2005). The NIOSH REL is intended to prevent acute and chronic irritation and sensitization of workers but not to prevent health effects in workers who are already sensitized. Per NIOSH, available data do not indicate a concentration at which MDI fails to produce adverse reactions in sensitized persons (NIOSH, 2006).

ACGIH. American Conference of Governmental Industrial Hygienists. Threshold Limit Values (TLVs) for MDI address respiratory sensitivity but not dermal sensitivity. It has been suggested that there is now sufficient information to recommend the addition of a “skin notation” to the TLVs for MDI to bring attention to the potential for absorption of diisocyanates through the skin.
ACGIH has assigned the MDI monomer a TLV of 0.05 mg/m^3 (0.005 ppm) as a Time-Weighted Average (TWA) for a normal 8-hour workday and a 40-hour workweek. The ACGIH TLV for MDI is based, among other things, upon the potential for sensitization and meant to protect workers from induction of this effect (ACGIH, 2009).